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ABSTRACT

This paper compares the achievement of first and second grade students in reduced size classrooms with the achievement of previous groups taught in larger classrooms in a Mississippi community. It also examines a longitudinal class size effect through the analysis of student achievement for two years. The subjects involved in the study were 371 first grade students and 309 second grade students grouped in heterogeneous classes of no more than 20 students during the 1988-89 school term. These groups were taught by a teacher and assistant teacher team and used the curriculum adopted by the school district. The same instructional materials were employed during the two-year research period. Data was also collected from 350 first graders taught during 1986-87 and from 313 second graders taught during 1987-88 in homogeneous classrooms of 27 students. The Stanford Achievement Test battery, Primary 1, was administered to the students to compare achievement. Significant differences in achievement in total reading, total mathematics, and total listening were found favoring the students who were taught in small classes. (RJC)

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DIFFERENCES IN ACHIEVEMENT FOR FIRST AND SECOND GRADERS ASSOCIATED WITH REDUCTION IN CLASS SIZE

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Though research literature is contradictory concerning the effects of reducing class size on student achievement, a meta-analysis by Glass and Smith (1979) of 80 studies reviewing the relationship between the two variables confirmed that "smaller is better" across different grades, subject matter and levels of student aptitude. In 1980 writers in Phi Delta Kappan challenged the methodology used by Glass and Smith, but Glass (1980) offered a point-by-point rebuttal of the Kappan challenge.

Sabrio, Pechman, and Rubin (1982) compared math and reading achievement gains for 1,233 "high need" first graders. In this carefully constructed study, classes of 22 students showed significant gains when compared to classes of 28 students in the same schools. Attitudes of teachers, parents, and principals were also highly favorable.

In 1987-88, a local school system located in a university town decided to reduce its class size from 27 to 20 for first graders. This policy was structured as a plan to support achievement while the school system switched from a system of homogeneous to heterogeneous ability grouping. Butler and Handley (1988) reported significant gains in achievement in all areas associated with this transition in class size.

At the end of that first year, the policy of reducing class size was continued to the second grade. In 1988-89 both first and second graders were taught in classes of 20. This paper reports the current status of achievement of students in both grades, as compared with that of previous groups taught in classes of 27 students. It also examines a longitudinal class size effect through the analysis of student achievement for two years.

Costs for reducing class size are not an attractive idea to the school system installing the procedure, but it is felt that achievement gains noted well justify the additional expense.

The Research Problem

The problem was to determine if differences in the achievement of first and second graders were associated with reduction in class size from 27 students to 20 students. It was hypothesized that reduction in class size would raise students' achievement on a standardized test. Traditional classes of 27 students were operationally defined as "large", and new classes with 20 students were called "small".

Questions to be Answered

The following questions were addressed in the study:

1. What differences existed in overall achievement for first and second grade students taught in large and small classes?

2. In which achievement areas were there differences in achievement between first and second graders, respectively, taught in large and small classes?

Research Procedures

The Design

The study was quasi-experimental in form with the independent variable of class size. Dependent variables were achievement scores in total reading, total listening, and total mathematics. Other dependent variables were achievement in the areas of word study skills, reading comprehension, vocabulary, word reading, listening comprehension, spelling, math concepts, math computations, math applications, environment, and reading. Since all students in first and second grades in 1988-89 attended classes having 20

students, it was necessary to use data from the previous year's first and second grades for the large group comparisons. No causal inferences were made. Data were interpreted as meaning that observed differences were associated with students' working in reduced class sizes. Part of this study is a replication, repeating the first grade analysis from the previous year. Last year Butler and Handley (1988) reported that large differences in achievement were observed for first graders taught in groups of 20, as compared to their counterparts taught in classes of 27 students.

Subjects

Subjects involved in the study were 371 first grade students and 309 second grade students grouped in classes of no more than 20 students during the 1988-89 school term. For comparison purposes, data were also collected from 350 first graders taught in 1986-87 and from 313 second graders taught in 1987-88 when maximum class size for these groups was 27 students. The total population of first and second graders in a separate school district in Mississippi was employed in this study. All students attended the same school. All teachers had at least AA, or Master's degree, certification.

Methods of Study

The Stanford Achievement Test (SAT) battery, Primary 1, was administered to the first and second graders in April in the routine testing program for each of the respective years. Test data reported by the SAT's publishers were employed as criterion variables in the study. The Stanford test was selected for use in Mississippi since its objectives most nearly parallel state objectives for instruction in basic skill areas. Reliability coefficients ranging from .86 to .98 are cited by its publishers (SAT, 1987) for achievement areas tested.

For the preceding two school years students in first and second grade were taught in heterogeneous groups with testing being conducted in the spring. Each grade was taught utilizing curriculum adopted by the school district. The same instructional materials were employed during the two year research period. An assistant teacher also worked with the teacher in each room. Hence, during the past two years, each class of 20 students was taught by a regular teacher and an assistant teacher.

Multivariate analysis of variance (MANOVA) and analysis of variance statistical models were used to analyze differences in student achievement (Nie, Hull, Jenkins, Steinbrenner, and Bert, 1975).

Results of Study

Results comparing the data from small classes of first graders (n=20) in the 1988-89 class confirmed the conclusions drawn from the 1987-88 group (Butler and Handley, 1988). Significant differences in achievement in total reading, total mathematics, and total listening were found favoring the first graders who were taught in small classes. The small classes achieved higher scores in all three areas. These data are given in Tables 1 and 2. In the MANOVA analysis where 10 subscales of the Stanford Achievement Test were considered as a composite criterion variable, significant differences were also indicated at the .001 level. Independent ANOVAs for each of the subscales also showed that students taught in classes of 20 students outscored those students in classes of 27 students on all criteria. See Tables 3 and 4.

Results of the MANOVA showed that second graders taught in classes having 20 or fewer students achieved significantly higher scores in the composite areas of total reading, total mathematics, and total listening than did the previous year's second graders who were taught in classes of 27 students.

These data are shown in Table 5. As shown in Table 6, these differences were found, primarily, in overall reading. No significant differences were indicated for achievement in listening or mathematics. A small effect size of .22 was shown for differences in reading means, favoring those second graders taught in small groups.

Further study was done of achievement in subscale areas to see where differences existed. The MANOVA solution, employing 11 subscale areas of achievement used as a composite criterion variable, showed a significant difference at the .001 level, as shown in Table 7. Univariate comparisons, reported in Table 8, demonstrated that the second graders in smaller classes outscored the larger groups in word study skills (.05 level), reading comprehension (.001 level), math computations (.05 level), math applications (.05 level), environment (.001 level), and reading (.01 level). No differences in achievement were associated with group size in the areas of word reading, vocabulary, listening comprehension, spelling, and math concepts.

Implications

These data confirm that achievement is enhanced when class sizes are reduced from 27 to 20 students in the first and second grades. Achievement gains are particularly apparent at the first grade level where those in small classes achieved from .3 to .5 standard deviations higher than did those in larger groups. Such achievement gains were expected since each class of 20 students was taught by a teacher and assistant teacher team. This structure allowed instruction of 10 students by each adult in the classroom. The assistant teachers in the school district studied were particularly well

trained. The town in which the school is located is a university setting, offering a list of well prepared candidates for the position.

Students in these classes were heterogeneously grouped. Their achievement was compared with that of those in previous years who were homogeneously grouped. These data show that students taught heterogeneously in small classes did better than those grouped homogeneously in larger classes in previous years.

Potential historical bias may have occurred in the study since this year's group was compared to that of a previous year. No differences, however, were noted in the curriculum or teaching methodology employed in the two years of instruction.

Teachers felt very positively about working with the small groups and were enthusiastic about continuing this practice. Grouping first and second graders in small classes is recommended as a continuing practice. It is further recommended that class size for third graders be reduced to 20, if financially feasible. It is believed that instruction resulting from such practice will diminish the slump in achievement test scores traditionally noted for fourth graders. Higher scores in reading comprehension, particularly, will enhance the achievement of these students as they grow older.

Table 1
Results of MANOVA Comparing Overall Achievement
for Large and Small Classes of First Graders

Number of Variables	Canonical R	Wilks Lambda	df	F
3	.21	.96	3,7177	10.76***

***p < .001

Table 2
Means, Standard Deviations, and Univariate
Comparisons for Large and Small Classes of First Graders

Variables	Small Classes (20)			Large Classes (27)			F
	N	$\bar{X}$	SD	N	$\bar{X}$	SD	
Total Reading	371	523.2	94.1	350	472.7	126.0	3.81***
Total Listening	371	561.2	68.6	350	506.7	185.4	27.98***
Total Mathematics	371	535.0	76.9	350	478.4	176.90	31.62***

***p < .001

Table 3
MANOVA Results for First Graders Showing Differences
on Achievement Subscales in Large and Small Classes

Number of Variables	Canonical R	Wilks Lambda	df	F
10	.34	.87	10,710	9.05***

***p < .001

Table 4
Means and Standard Deviations on Achievement Subscales
for Large and Small Classes of First Graders

Variables	Small Classes (20)			Large Classes (27)			F
	N	$\bar{X}$	SD	N	$\bar{X}$	SD	
Word Study Skills	371	522.4	87.8	350	474.9	176.3	26.36***
Word Reading	371	523.7	78.7	350	467.6	173.2	31.95***
R Comprehension	371	524.7	87.8	350	472.6	179.9	25.90***
Vocabulary	371	558.4	70.9	350	503.0	184.7	28.86***
L Comprehension	371	464.8	69.5	350	511.3	187.6	26.29***
Spelling	371	498.6	78.5	350	444.7	117.2	30.09***
Concepts of Numbers	371	540.0	75.7	350	474.5	176.5	42.80***
Math Concepts/App.	371	535.9	76.8	350	483.8	179.2	26.25***
Environment	371	558.9	67.7	350	494.4	186.0	39.05***
Reading	371	523.8	88.1	350	469.8	175.4	28.15***

***p < .001

Table 5
Results of MANOVA Showing Overall Differences in Achievement
of Second Graders Taught in Small and Large Classes

Number of Variables	Canonical R	Wilks Lambda	df	F
3	.13	.98	3,606	3.56*

*p < .05

Table 6
Means and Standard Deviations in Total Reading, Listening and Mathematics for Small and Large Classes of Second Grade

Variable	Small Classes (20)			Large Classes (27)			
	N	$\bar{X}$	SD	N	$\bar{X}$	SD	F
Total Reading	308	596.1	51.0	311	584.9	49.0	7.17**
Total Listening	306	601.3	38.4	309	594.5	42.8	.29
Total Mathematics	309	574.9	42.8	311	572.1	41.9	3.22

**p < .01

Table 7
MANOVA Results for Second Graders Showing Differences in Subscale Achievement Areas for Large and Small Classes

Number of Variables	Canonical R	Wilks Lambda	df	F
11	.23	.995	11,598	2.99***

***p <.001

Table 8
Means and Standard Deviations for Achievement Subareas
for Second Graders in Large and Small Classes

Variables	Small Classes (20)			Large Classes (27)			
	N	$\bar{X}$	SD	N	$\bar{X}$	SD	F
Word Study Skills	309	605.9	59.6	313	596.2	59.3	4.14*
Word Reading	309	587.7	53.4	313	580.5	56.9	2.37
R Comprehension	308	594.2	48.8	312	580.8	50.5	10.23***
Vocabulary	306	601.6	48.4	309	600.5	52.3	.07
L Comprehension	306	603.8	38.6	309	600.3	41.3	1.10
Spelling	306	598.8	50.2	308	591.7	59.9	2.40
Math Concepts	309	582.3	47.6	313	578.6	44.9	1.01
Math Applications	309	561.8	44.4	312	554.4	50.0	4.54*
Math Computations	309	591.2	54.4	313	579.7	62.3	6.22*
Environment	306	595.5	38.8	309	585.5	36.9	10.65***
Reading	308	590.2	49.6	311	578.7	51.2	7.05*

*$p < .05$
**$p < .01$
***$p < .001$

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